

REMARKS

This is responsive to the Office Action mailed November 15, 2006. Applicants respectfully submit that the claims as set forth herein patentably distinguish over the references, and accordingly ask that claims 2-9, 18, 23, and 26-29 as set forth herein be reconsidered and allowed.

Status of the Claims

Claims 1-9 and 18-29 are pending. Claims 10-17 were canceled responsive to a previous restriction requirement.

Claims 1, 7-9, 18-21, and 23-25 stand rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by Shieh et al., U.S. Patent No. 5,780,321 (hereinafter "Shieh").

Claims 2-5, 22, and 26-28 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Shieh.

Claim 6 stands rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Shieh in view of Goossen et al., U.S. Patent No. 5,923,951 (hereinafter "Goossen").

Claim 29 stands rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Shieh in view of Camras et al., U.S. Patent No. 6,784,463 (hereinafter "Camras").

The objections to the specification and drawings are addressed

The title has been amended as suggested in the Office Action.

Claim 6 has been amended to refer to only a single mesa. Accordingly, it is respectfully submitted that there is no need to illustrate a plurality of mesas. As amended, claim 6 calls for the removing of the deposition substrate to effect a physical separation of the mesa wherein the mesa defines a separated light emitting diode device die flip-chip bonded to the thermally conductive support. The mesa 24' illustrated in Fig. 5 is, at a minimum, separated from the substrate 12' shown in Fig. 4 by the removing.

The recited "separation of the mesas 24' at the trenches 26'" at page 8 line 13 has been amended to refer to a single mesa 24' and single trench 26' which is consistent with the singular features 24' and 26' shown in the drawings. A following line has been added by amendment restating the original text without reference to the illustrated features,

namely that "If there are a plurality of mesas on the substrate 12', then the removal of the GaAs substrate 12' from the mesas will effect a physical separation of the mesas from one another." It is believed that this additional line does not constitute new matter, but merely states what was already set forth, but without referring to "mesas 24'" which is not illustrated. Moreover, there is no need to illustrate what is described in this line since it is not called out in the claims (in view of the amendment to claim 6).

Accordingly, it is respectfully requested that the objections to the specification and drawings be withdrawn.

Objected claim 21 is canceled

Claim 21 is canceled, thus obviating the objection to this claim.

The claims distinguish over the references of record

Claim 2 has been placed into independent form including the limitations of canceled base claim 1. Claim 2 calls for a method of manufacturing a light emitting diode, the method comprising: depositing a plurality of semiconductor layers on a deposition substrate; removing at least some of the deposited semiconductor layers from a selected trench region of the deposition substrate to define a light-emissive mesa; forming an electrode on the mesa; flip-chip bonding the mesa to a first electrical bonding pad of a thermally conductive support; removing the deposition substrate; and subsequent to the removing of the deposition substrate, depositing a light-transmissive, electrically conductive window layer on a surface of the mesa opposite the electrode, the window layer extending laterally to electrically contact a second electrical bonding pad of the thermally conductive support to define an electrical path between the mesa and the second electrical bonding pad.

In rejecting claim 2 as allegedly unpatentable over Shieh, the Office Action recognizes that Shieh does not expressly or inherently disclose depositing a light-transmissive, electrically conductive window layer subsequent to removing the deposition substrate. Indeed, the Office Action recognizes that Shieh teaches an opposite

sequence in which the layer (16) [referred to in the Office Action, but not in Shieh, as a window layer] is deposited as part of the stack of device layers including the etch stop (15), conductive layer (16), confinement layer (17), active layer (18), and carrier confinement layer (19). However, the Office Action notes Sheih's comment that "it should be understood that various steps of the disclosed method may be interchanged and/or combined with other steps in specific applications and it is fully intended that all such changes in the disclosed methods come within the scope of the claims." Shieh col. 8 lines 36-41. Based on this statement, the Office Action proposes the following motivation "at least to prevent possible damage to the window layer during removal of the deposition substrate" citing Shieh col. 8 lines 3-6.

Respectfully, Shieh does not disclose or remotely suggest this motivation. The cited section of Sheih merely states that the substrate can be removed by wet etching or any alternative etching technique. It does not express any concern about damage to the window layer during substrate removal. Indeed, Shieh teaches use of a release layer in conjunction with a selective etchant. Shieh col. 8 lines 6-10. As is known in the art, the release layer and selective etchant are selected precisely because the etchant attacks the release layer but not adjacent material such as layer (16). As an alternative approach, Shieh teaches using an etch stop layer (15) comprised of a different material than the substrate (12) and having as its major purpose facilitating the removal of the substrate (12). Shieh col. 4 lines 36-42. Etching of the substrate stops at the etch stop (15) since it is of a different material not attacked by the etching. Note in Fig. 2 that the etch stop (15) is between the substrate (12) and the layer (16) – thus, in this approach the etching never reaches the layer (16). Whether using a release layer approach or the etch stop approach, in either case there is no concern about damaging the window layer.

Moreover, the proposed modification of Shieh is not merely a rearrangement or combination of steps such as is mentioned at Shieh col. 8 lines 36-41. Rather, it would involve an additional deposition step nowhere disclosed or fairly suggested in Shieh. The disclosed approach of Shieh is epitaxial growth of the stack of layers (15)-(19) in that order. To deposit layer (16), which is near the bottom of this stack of layers, after substrate removal requires an additional deposition operation separate from the disclosed deposition of layers (15)-(19). Specifically: first, deposition of layers (15), [no layer (16)

since the proposed modification is to not deposit this layer at this time], (17), (18), (19) in that order on the substrate (12). Second, substrate removal. Third, an additional deposition step to deposit layer (16) on top of the now-exposed layer (17). This additional deposition step is wholly new, and nowhere disclosed or fairly suggested in Shieh.

The specification of the present application (not Shieh) provides the following motivational disclosure. Because the window layer is deposited after removal of the substrate and not as part of the stack of semiconductor layers, the window layer can be selected for preferred electrical and optical characteristics. Suitable materials for the window layer include sputtered indium tin oxide, GaP or AlGaAs grown by liquid phase epitaxy, or the like. The window layer is preferably at least two microns thick – as a separate deposition, a fast deposition technique such as sputtering or liquid phase epitaxy can be employed. In contrast, the epitaxial window of the embodiment of FIGURES 1 and 2 is grown along with the stack of semiconductor layers by metalorganic chemical vapor deposition or molecular beam epitaxy, which are slower layer deposition techniques. Application at page 8 lines 18-28.

Claim 4 has been amended to call for the depositing of the plurality of semiconductor layers to comprise depositing said semiconductor layers by a deposition technique selected from the group consisting of metalorganic chemical vapor deposition and molecular beam epitaxy, and for the depositing of a window layer to include depositing at least one window layer by liquid phase epitaxy. Nothing in Shieh discloses or fairly suggests using a different epitaxial technique for growing the layer (16) as compared with the other epitaxial layers (15), (17), (18), (19).

Claim 5 calls for the depositing of the window layer to includes non-epitaxially depositing at least one window layer. Shieh expressly teaches epitaxially depositing the layer (16) as part of the stack of epitaxial layers (15), (16), (17), (18), (19) (Shieh col. 4 lines 46-50) and nothing in Shieh would motivate the skilled artisan to do otherwise.

Independent **claim 18** has been amended to incorporate the subject matter of canceled claim 22, namely calling for, subsequent to the removing of the epitaxy substrate, depositing an electrically conductive, light-transmissive window layer over the device mesa and the second electrode, the window layer forming an electrical connection

between the device mesa and the second electrode. The comments pertaining to claim 2 pertain to claim 18 as well.

Claim 26 has been placed into independent form incorporating the limitations of canceled base claims 1 and 24 and the limitation of canceled claim 25. This claim is analogous to claim 2, but includes more specific material identifications including requiring that the substrate be GaAs and that the deposited plurality of semiconductor layers include group III-phosphide layers. The comments pertaining to claim 2 pertain to claim 26 as well.

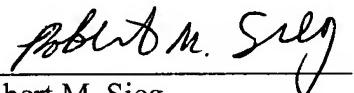
In view of the foregoing, it is respectfully submitted that all claims 2-9, 18, 23, and 26-29 as set forth herein patentably distinguish over the references of record. Accordingly, an early allowance of claims 2-9, 18, 23, and 26-29 as set forth herein is earnestly requested.

CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims 2-9, 18, 23, and 26-29 as set forth herein are in condition for allowance and that all informalities have been remedied. Accordingly, an early indication of allowance of the application is earnestly requested.

Respectfully submitted,

FAY, SHARPE LLP



Robert M. Sieg
Reg. No. 54,446
1100 Superior Avenue, 7th Floor
Cleveland, OH 44114-2579
Phone: (216) 861-5582
Fax: (216) 241-1666